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(54) **HERMETIC RECIPROCATING COMPRESSOR**

HERMETISCHER HUBKOLBENVERDICHTER

COMPRESSEUR ALTERNATIF HERMÉTIQUE

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(73) Proprietor: **Samsung Electronics Co., Ltd.
Gyeonggi-do 443-742 (KR)**

(72) Inventor: **Kim, Jung Hyoun
Gwangju (KR)**

(74) Representative: **Grünecker Patent- und
Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)**

(56) References cited:
**CN-A- 1 701 182 US-A1- 2007 020 126
US-A1- 2011 265 510**

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Description

BACKGROUND

1. Field

[0001] Embodiments relate to an oil supply structure of a hermetic reciprocating compressor in which a compression mechanism to compress a refrigerant through reciprocation of a piston and a power transmission mechanism to generate driving force are integrated and accommodated in a hermetic case.

2. Description of the Related Art

[0002] In general, a compressor, which is one of the components of a refrigeration cycle apparatus, is designed to compress a refrigerant at high temperature and high pressure. The compressors may be divided into various types depending on the compression technique and the sealing structure. Among other compressors, the hermetic reciprocating compressor includes a compression mechanism to compress the refrigerant through reciprocation of a piston and a power transmission mechanism to drive the compression mechanism, and has the compression mechanism and the power transmission mechanism installed in one hermetic case.

[0003] Such a hermetic reciprocating compressor includes a rotating shaft to transmit driving force from the power transmission mechanism to the compression mechanism. Also, a lower portion of the hermetic case retains oil used to lubricate and cool components of each mechanism, and the rotating shaft is provided with an oil supply structure to raise the oil to supply the same to each component.

[0004] An example of such a compressor is disclosed in Korean Patent Application Publication No. KR 2005-0052011 A. According to this document, an inner channel is provided in the lower portion of the rotating shaft to raise the oil, and a spiral groove connected to the inner channel is formed on the outer circumferential surface of the upper portion of the rotating shaft, which is supported by a shaft support of a frame.

[0005] Another example of such a compressor is described in US 2007/0020126 A1. According to this document, an oil pick-up member is connected to a lower end of the rotating shaft to raise oil gathered in the bottom of a hermetic case. An eccentric hole is provided along a lower portion of the rotating shaft to enable the oil to be raised inside the shaft. At an upper portion of the rotating shaft, an external spiral groove is formed in the outer circumferential surface of the rotating shaft. The external groove is connected to the eccentric hole so as to be supplied with oil. Oil can be guided upward along the external spiral groove when the rotating shaft rotates. The upwardly moved oil serves to lubricate and cool both the outer surface of the rotating shaft and an inner surface of a shaft supporting portion. After having been raised

through the external spiral groove, the oil is guided into a hollow channel provided inside an eccentric portion for transmitting power to the compression mechanism. An upper end of that hollow channel may be open such that the oil can be supplied to a piston connected to the eccentric portion. According to an embodiment, another spiral groove may be formed at an external surface of the eccentric portion such that oil scattered and dropped from the hollow channel of the eccentric portion may move downward along the spiral groove to lubricate and cool a frictional interface between the eccentric portion and the compression mechanism.

[0006] The oil retained in the hermetic case configured as above is guided through the inner channel formed in the rotating shaft to the spiral groove formed on the outer circumferential surface of the rotating shaft. When the oil is raised, it lubricates the parts on the outer circumferential surface of the rotating shaft between the rotating shaft and the shaft support.

[0007] However, since the oil lubricates the parts between the rotating shaft and the shaft support while being raised, surface pressure of the shaft support applied to the oil may limit the rising speed of the oil, thus limiting reduction in revolutions per minute (RPM) of the rotating shaft.

SUMMARY

[0008] It is an object of the invention to provide a compressor having an oil supply structure to raise oil retained in the lower portion of a hermetic case, in which the oil is raised even at low revolutions per minute (RPM) of a rotating shaft.

[0009] This object is achieved by the subject-matter of claim 1. The dependent claims describe advantageous embodiments of the invention.

[0010] In an aspect of one or more embodiments, there is provided an oil supply structure in which the diameter of a rotating shaft may be minimized.

[0011] In an aspect of one or more embodiments, there is provided a compressor which includes a hermetic case to retain oil in a lower portion thereof, a frame accommodated in the hermetic case, a compression mechanism provided with a cylinder fixed to the frame, and a piston to reciprocate to compress a refrigerant in the cylinder, a power transmission mechanism provided with a stator fixed to the frame and a rotor adapted to rotate inside the stator, a rotating shaft coupled to the rotor to rotate together with the rotor and provided with an eccentric part to convert rotational motion of the rotor into translational motion of the piston and a hollow portion to raise the oil retained in the hermetic case, and a fixation shaft inserted into the hollow portion of the rotating shaft, fixed to one of the stator and the frame, and provided with a spiral wing on an outer circumferential surface thereof to raise the oil retained in the hermetic case in cooperation with an inner circumferential surface of the rotating shaft when the rotating shaft rotates.

[0012] The frame may include a shaft support to accommodate the rotating shaft to support the rotating shaft, wherein a spiral groove may be formed on an outer circumferential surface of the rotating shaft to lubricate contact surfaces of the rotating shaft and the shaft support.

[0013] The rotating shaft may be provided with a guide passage to guide oil in the hollow portion of the rotating shaft to the spiral groove of the rotating shaft.

[0014] Also, the spiral groove of the rotating shaft and the spiral wing of the fixation shaft may be formed in opposite directions.

[0015] Also, the rotating shaft may be formed of a metal material, and the fixation shaft may be formed of a synthetic resin material.

[0016] The compressor may further include a fixing member to fix the fixation shaft to one of the stator and the frame.

[0017] The fixing member is a wire coupled to the fixation shaft by penetrating the fixation shaft.

[0018] The fixation shaft may include a protrusion protruding downward to be coupled to the fixing member when inserted into the hollow portion of the rotating shaft, wherein the protrusion of the fixation shaft may be provided with a through hole penetrated by the fixing member.

[0019] Also, the fixing member may include a coupling portion coupled to the rotating shaft, a hook portion coupled to one of the stator and the frame, and at least one extension to connect the coupling portion with the hook portion, wherein one of the stator and the frame may include a stopping portion allowing the hook portion to be coupled thereto.

[0020] At least one extension may include a first extension extending upward from the coupling portion, a second extension extending from the first extension in a radial direction, and a third extension extending upward from the second extension.

[0021] In accordance with an aspect of one or more embodiments, there is provided a compressor which includes a hermetic case to retain oil in a lower portion thereof, a frame accommodated in the hermetic case, a compression mechanism provided with a cylinder fixed to the frame, and a piston to reciprocate to compress a refrigerant in the cylinder, a power transmission mechanism provided with a stator fixed to the frame and a rotor adapted to rotate inside the stator, a rotating shaft coupled to an inside of the rotor to rotate together with the rotor and provided with an eccentric part to convert rotational motion of the rotor into translational motion of the piston and a hollow portion to raise the oil retained in the hermetic case, and a spiral member inserted into the hollow portion of the rotating shaft, and coupled to an inner circumferential surface of the rotating shaft to rotate together with the rotating shaft to raise the oil retained in the hermetic case in cooperation with the inner circumferential surface of the rotating shaft.

[0022] The compressor may further include a cap

member coupled to an end of the rotating shaft to support the spiral member.

[0023] The cap member may be provided with a support surface to support the spiral member.

[0024] Also, the compressor may further include a fixation shaft inserted into the hollow portion of the rotating shaft to support the spiral member.

[0025] The compressor may further include a fixing member to fix the fixation shaft to one of the stator and the frame.

[0026] Also, the frame may include a shaft support to accommodate the rotating shaft to support the rotating shaft, wherein a spiral groove may be formed on an outer circumferential surface of the rotating shaft to lubricate contact surfaces of the rotating shaft and the shaft support.

[0027] The rotating shaft is provided with a guide passage to guide oil in the hollow portion of the rotating shaft to the spiral groove of the rotating shaft.

[0028] In accordance with an aspect of one or more embodiments, there is provided a compressor includes a hermetic case to retain oil in a lower portion thereof, a frame accommodated in the hermetic case, a compression mechanism provided with a cylinder fixed to the frame, and a piston to reciprocate to compress a refrigerant in the cylinder, a power transmission mechanism provided with a stator fixed to the frame and a rotor adapted to rotate inside the stator, and a rotating shaft provided with a hollow portion having a raising member to raise the oil retained in the hermetic case disposed therein, and a spiral groove communicating with the hollow portion and formed on an outer circumferential surface of the rotating shaft, wherein the oil retained in the hermetic case is raised through an inner circumferential surface of the rotating shaft, and the raised oil lubricates the rotating shaft while descending through the spiral groove.

[0029] The raising member may be a spiral member.

[0030] The raising is a spiral wing of a fixation shaft disposed in the hollow portion of the rotating shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] These and/or other aspects of embodiments will become apparent and more readily appreciated from the following description of embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a cross-sectional view schematically illustrating a compressor according to an exemplary embodiment;

FIG. 2 is a rear perspective view illustrating a fixing structure of a fixation shaft of the compressor in FIG. 1;

FIG. 3 is an exploded perspective view illustrating coupling between the rotating shaft and the fixation shaft of the compressor of FIG. 1;

FIG. 4 is a cross-sectional view illustrating ascent of oil of the compressor of FIG. 1;

FIG. 5 is a view illustrating descent of oil of the compressor of FIG. 1;

FIG. 6 is an exploded perspective view illustrating coupling between a rotating shaft and a fixation shaft of a compressor according to an exemplary embodiment;

FIG. 7 is a cross-sectional view illustrating ascent of oil of the compressor of FIG. 6; and

FIG. 8 is a view illustrating descent of oil of the compressor of FIG. 6.

DETAILED DESCRIPTION

[0032] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0033] FIG. 1 is a cross-sectional view schematically illustrating a compressor according to an exemplary embodiment, FIG. 2 is a rear perspective view illustrating a fixing structure of a fixation shaft of the compressor in FIG. 1, and FIG. 3 is an exploded perspective view illustrating coupling between the rotating shaft and the fixation shaft of the compressor of FIG. 1.

[0034] Referring to FIGS. 1 to 3, the compressor 1 includes a hermetic case 10, a frame 12 to fix various components inside the hermetic case 10, a compression mechanism 20 installed at an upper side of the frame 12, a power transmission mechanism 30 installed at a lower side of the frame 12 to drive the compression mechanism 20, and a rotating shaft 40 vertically arranged to transmit driving force from the power transmission mechanism 30 to the compression mechanism 20 and rotatably supported by a shaft support 13 of the frame 12.

[0035] The compression mechanism 20 includes a cylinder 21 defining a compression space for a refrigerant and fixed to the frame 12, and a piston 22 to move forward and backward in the cylinder 21 to compress the refrigerant.

[0036] The power transmission mechanism 30 includes a stator 32 fixed to the frame 12 and a rotor 31 to rotate inside the stator 32. The rotor 31 includes a through hole to accommodate the rotating shaft 40. The rotating shaft 40 is press-fitted into the through hole of the rotor 31, and is allowed to rotate together with the rotor 31.

[0037] An eccentric part 41 eccentrically disposed about the rotational axis is formed at an upper portion of the rotating shaft 40, and is connected to the piston 22 via a connecting rod 23. Accordingly, rotational motion of the rotating shaft 40 may be converted into rectilinear translational motion of the piston 22.

[0038] A circular plate 42 extending in a radial direction

may be formed at a lower portion of the eccentric part 41. Thrust bearings 43 may be interposed between the circular plate 42 and the shaft support 13 to allow smooth rotation of the rotating shaft 40 and at the same time support an axial load of the rotating shaft 40.

[0039] Oil to lubricate and cool various components of the compressor 1 is retained in the lower portion of the hermetic case 10. The oil is raised through the rotating shaft 40 and supplied to the components.

[0040] In particular, the rotating shaft 40 is provided with a hollow portion 44 allowing the oil retained in hermetic case to be raised through the inner circumferential surface thereof. A fixation shaft 50 may be inserted into the hollow portion 44. The fixation shaft 50 may be fixed to the stator 32 by a fixing member 60. Accordingly, the fixation shaft 50 may not rotate when the rotating shaft 40 rotates.

[0041] The fixation shaft 50 may include, as shown in FIG. 2, a protrusion 52 protruding downward to be coupled to the fixing member 60. The protrusion 52 may be provided with a through hole 53 penetrated by the fixing member 60.

[0042] The fixing member 60 may be a wire. The fixing member 60 may be curved at several positions. The fixing member 60 may include a coupling portion 61 to penetrate the through hole 53 of the rotating shaft 40, a hook portion 65 coupled to the stopping portion 32a of the stator 32, and extensions 62, 63 and 64 to connect the coupling portion 61 with the hook portion 65.

[0043] The stopping portion 32a of the stator 32 may have a shape of a groove to accommodate the hook portion 65. The coupling portion 61 of the fixing member 60 may be fitted into the hook portion 65.

[0044] The fixing member 60 may be coupled to the stator 32 after the fixation shaft 50 and the fixing member 60 are coupled to each other. That is, the hook portion 65 of the fixing member 60 may be coupled to the stopping portion 32a of the stator 32 after the fixing member 60 is inserted into the through hole 53 of the fixation shaft 50.

[0045] Here, the fixing member 60 may be formed of an elastic material such as a leaf spring. Therefore, the fixing member 60 may be slightly widened when it is coupled to the stator 32, and after the fixing member 60 is coupled to the stator 32, the fixing member 60 may be firmly coupled to the stator 32 by the restoring force of the fixing member 60.

[0046] The extensions 62, 63 and 64 of the fixing member 60 may include a first extension 62 extending approximately upward from the coupling portion 61, a second extension 63 extending in an approximately radial direction from the first extension 62, and a third extension 64 extending approximately upward from the second extension 63.

[0047] In the illustrated embodiment, the fixing member 60 is coupled to the stator 32. However, embodiments are not limited thereto. The fixing member 60 may be coupled to the frame 12 or any structure in the hermetic

case 10.

[0048] A rotating wing 51 may be formed on the outer circumferential surface of the fixation shaft 50 to raise oil retained in the hermetic case 10 in cooperation with the inner circumferential surface of the rotating shaft 40. Accordingly, when the rotating shaft 40 rotates, the oil retained in the hermetic case 10 may be raised along the rotating wing 51 of the fixation shaft 50 as it is rotated by adhesion of the rotating shaft 40 in a direction in which the rotating shaft 40 rotates.

[0049] Also, a spiral groove 46 may be formed on the outer circumferential surface of the rotating shaft 40 to allow the raised oil to lubricate and cool the portion between the rotating shaft 40 and the shaft support 13 as the oil descends. A guide passage 45 (FIG. 4) may be provided in the rotating shaft 40 to allow the hollow portion 44 to communicate with the spiral groove 46 therethrough such that the oil in the hollow portion 44 is guided to the spiral groove 46.

[0050] Hereinafter, ascent and descent of oil as above will be further described with reference to the drawings.

[0051] FIG. 4 is a cross-sectional view illustrating ascent of oil of the compressor of FIG. 1, and FIG. 5 is a view illustrating descent of the oil of the compressor of FIG. 1.

[0052] In FIG. 4, symbol A, which represents the direction of rotation of the rotating shaft 40, indicates that the rotating shaft 40 rotates clockwise when viewed from the top side of the FIG. 4. Hereinafter, the direction of rotation is the direction when the rotating shaft 40 is viewed from the top side thereof. In FIG. 4, symbol B indicates the direction of ascent of the oil. In FIG. 5, symbol C indicates the direction of descent of the oil.

[0053] As shown in FIGS. 4 and 5, when the rotating shaft 40 rotates clockwise, the oil retained in the hermetic case may be rotated clockwise by adhesion thereof to the rotating shaft 40. As the oil rotates clockwise, it may rise along the spiral wing 51 formed on the outer circumferential surface of the fixation shaft 50. That is, centrifugal force according to rotation may be converted into lifting force by the spiral wing 51 such that the oil rises. At this time, the fixation shaft 50 and the spiral wing 51 may not rotate when the rotating shaft 40 rotates as described above.

[0054] When the oil is raised to the upper end of the hollow portion 44 of the rotating shaft 40, it may be further raised through a first supply channel 47a formed in the eccentric part 41. The first supply channel 47a may be formed to be approximately inclined with respect to the central axis P of the rotating shaft. Since the eccentric part 41 eccentrically rotates about the central axis P of the rotating shaft, the oil may be raised from the first supply channel 47a by the centrifugal force. The oil raised through the first supply channel 47a may be discharged to the upper side of the eccentric part 41 to lubricate the eccentric part 41 and other structures.

[0055] Also, a second supply channel 47b may be formed in a radial direction at one point in the first supply

channel 47a. The oil may be supplied to the connecting rod 23 (FIG. 1) through the second supply channel 47b.

[0056] Also, after the oil is raised to the upper end of the hollow portion 44 of the rotating shaft 40, it may be guided to the spiral groove 46 formed on the outer circumferential surface of the rotating shaft 40 through the guide passage 45. As shown in FIG. 5, the oil guided to the spiral groove 46 may lubricate and cool the outer circumferential surface of the rotating shaft 40 and the inner circumferential surface of the shaft support 13 (FIG. 1) as it descends along the spiral groove 46.

[0057] At this time, the oil in the spiral groove 46 may descend by gravity even when the centrifugal force is not present. Thus, the spiral groove 46 may be formed in a direction opposite to the direction in which the spiral wing 51 is formed as shown in FIG. 5. Although not shown, the spiral groove 46 may also be formed in the same direction as the spiral wing 51.

[0058] As such, the compressor 1 according to the illustrated embodiment may raise the oil through the inner circumferential surface of the rotating shaft 40. Therefore, compared to a conventional structure in which oil is raised through the outer circumferential surface of the rotating shaft 40, and thereby passage of oil is interfered with by the surface pressure of the shaft support (or adhesion thereof to the shaft support) and thus RPM of the rotating shaft needs to be maintained over a predetermined level to raise the oil, the compressor 1 according to the illustrated embodiment may cause the oil to rise at a lower RPM of the rotating shaft by ensuring that the surface pressure of the shaft support 13 is not applied to the oil when the oil is raised.

[0059] For the same reason, since the oil is raised at a lower centrifugal force than in conventional cases, the diameter of the rotating shaft may be reduced.

[0060] FIG. 6 is an exploded perspective view illustrating coupling between a rotating shaft and a fixation shaft of a compressor according to an exemplary embodiment, FIG. 7 is a cross-sectional view illustrating ascent of oil of the compressor of FIG. 6, and FIG. 8 is a view illustrating descent of oil of the compressor of FIG. 6.

[0061] A rotating shaft 70, fixation shaft 90, spiral member 80 and cap member 100 of the compressor according to another embodiment will be described below with reference to FIGS. 6 and 7. Other components of the compressor which are not described below are the same as those of the compressor according to the previous embodiment.

[0062] The compressor according to the illustrated embodiment may include a rotating shaft 70 having a hollow portion 74, a spiral member 80 inserted into the hollow portion 74 of the rotating shaft 70 to rotate together with the rotating shaft 70 to raise oil in the hermetic case, a cap member 100 coupled to an end of the rotating shaft 70 to support the spiral member 80, and a fixation shaft 90 inserted into the hollow portion 74 of the rotating shaft 70 to support the spiral member 80.

[0063] The rotating shaft 70 includes an eccentric part

71 to eccentrically rotate to convert rotational motion of the rotating shaft 70 into rectilinear translational motion, a circular plate 72 formed at the lower side of the eccentric part 71 to support the rotating shaft 70, a hollow portion 74 to raise oil, and a spiral groove 76 allowing the raised oil to descend to lubricate and cool the rotating shaft 70 and surrounding structures thereof.

[0064] The eccentric part 71 may be provided with a first supply channel 77a to supply the oil raised through the hollow portion 74 to an upper side of the eccentric part 71, and a second supply channel 77b to supply the oil raised through the hollow portion 74 to a lateral side of the eccentric part 72.

[0065] The rotating shaft 70 may be provided with a guide passage 75 to supply the oil raised through the hollow portion 74 to the spiral groove 76.

[0066] The spiral member 80 may be coupled to the hollow portion 74 of the rotating shaft 70 to closely contact the inner circumferential surface of the rotating shaft 70. The spiral member 80 may rotate together with the rotating shaft 70. Therefore, when the rotating shaft 70 rotates in direction D, the spiral member 80 may also rotate in direction D to raise the oil. That is, the spiral member 80 may raise the oil using a vertical component of the centrifugal force. A common spring may be used for the spiral member. A spiral member support 79 to support the upper end of the spiral member 80 may be formed at an upper portion of the rotating shaft 70. The spiral member support 79 may be formed to protrude from the inner circumferential surface of the rotating shaft 70.

[0067] The cap member 100 may be coupled to the lower end of the rotating shaft 70 to support the spiral member 80. The insert portion 78 of the rotating shaft 70 may be fitted into the accommodation portion 102 of the cap member 100. Therefore, the cap member 100 may rotate together with the rotating shaft 70 and the spiral member 80. The cap member 100 may be provided with a rotating shaft support surface 103 to closely contact the rotating shaft 70, and a spiral member support 101 to support the lower end of the spiral member 80. The spiral member support 101 may be formed to protrude toward the inside of the cap member 100.

[0068] The fixation shaft 90 may be inserted into the hollow portion 74 of the rotating shaft 70 to support the spiral member 80. As in the illustrated embodiment, the fixation shaft 90 may be fixed to the stator 32 (FIG. 1) or the frame 12 (FIG. 1) by the fixing member 60 (FIG. 2). Therefore, the fixation shaft 90 may not rotate together with the rotating shaft 70. The fixation shaft 90 may include a protrusion 91 protruding downward to allow the fixing member 60 to be coupled thereto, a through hole 92 formed at the protrusion 91 to be penetrated by the fixing member 60.

[0069] In the compressor having the configuration as above, when the rotating shaft 70 rotates in direction D, the spiral member 80 also rotates in direction D, and thus the oil in the hermetic case may be raised by a vertical component of centrifugal force (E). The oil in the hermetic

case may be easily raised, not interfered with by the surface pressure of the shaft support 13. Accordingly, compared to conventional cases, the oil may be raised at low RPM of the rotating shaft, and the diameter of the rotating shaft 70 may be reduced.

[0070] The oil raised as above is guided to the spiral groove 76 on the outer circumferential surface of the rotating shaft 70 through the guide passage 75, and may lubricate and cool the adjacent portions of the rotating shaft 70 and the shaft support 13 as it descends along the spiral groove 76 (F).

[0071] As is apparent from the above description, oil retained in the hermetic case is allowed to be raised through the inner circumferential surface of the rotating shaft, and not through the outer circumferential surface of the rotating shaft to which the surface pressure of the shaft support is applied, and therefore oil may be raised at a lower RPM than in conventional cases.

[0072] Also, the oil may be raised with a lower centrifugal force and thus the diameter of the rotating shaft may be reduced.

[0073] Although a few embodiments have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

Claims

1. A compressor (1) comprising:

- a hermetic case (10) to retain oil in a lower portion thereof;
- a frame (12) accommodated in the hermetic case (10);
- a compression mechanism (20) provided with a cylinder (21) fixed to the frame (12), and a piston (22) to reciprocate to compress a refrigerant in the cylinder (21);
- a power transmission mechanism (30) provided with a stator (32) fixed to the frame (12) and a rotor (31) adapted to rotate inside the stator (32); and
- a rotating shaft (40, 70) provided with a hollow portion (44, 74) having a raising member to raise the oil retained in the hermetic case (10) disposed therein, and a spiral groove (46, 76) communicating with the hollow portion (44, 74) and formed on an outer circumferential surface of the rotating shaft (40, 70),
- wherein the oil retained in the hermetic case (10) is raised through an inner circumferential surface of the rotating shaft (40, 70), and the raised oil lubricates the rotating shaft (40, 70) while descending through the spiral groove (46, 76),
- wherein the hollow portion (44, 74) has a length

which extends substantially the entire length of the rotating shaft (40, 70), and the raising member extends substantially the entire length of the hollow portion (44, 74).

2. The compressor according to claim 1, wherein the raising member is a fixation shaft (50) fixed to one of the stator (32) and the frame (12), and provided with a spiral wing (51) on an outer circumferential surface thereof to raise the oil retained in the hermetic case (10) in cooperation with an inner circumferential surface of the rotating shaft (40) when the rotating shaft (40) rotates.
3. The compressor according to claim 1, wherein the rotating shaft (40, 70) is provided with a guide passage (45, 75) to guide oil in the hollow portion (44, 74) of the rotating shaft (40, 70) to the spiral groove (46, 76) of the rotating shaft (40, 70).
4. The compressor according to claim 2, wherein the spiral groove (46) of the rotating shaft (40) and the spiral wing (51) of the fixation shaft (50) are formed in opposite directions.
5. The compressor according to claim 2, wherein the rotating shaft (40) is formed of a metal material, and the fixation shaft (50) is formed of a synthetic resin material.
6. The compressor according to claim 2, further comprising a fixing member (60) to fix the fixation shaft (50) to one of the stator (32) and the frame (12).
7. The compressor according to claim 6, wherein the fixing member (60) is a wire coupled to the fixation shaft (50) by penetrating the fixation shaft (50).
8. The compressor according to claim 7, wherein the fixation shaft (50) comprises a protrusion (52) protruding downward to be coupled to the fixing member (60) when inserted into the hollow portion (44) of the rotating shaft (40), wherein the protrusion (52) of the fixation shaft (50) is provided with a through hole (53) penetrated by the fixing member (60).
9. The compressor according to claim 7, wherein the fixing member (60) comprises a coupling portion (61) coupled to the rotating shaft (40), a hook portion (65) coupled to one of the stator (32) and the frame (12), and at least one extension to connect the coupling portion (61) with the hook portion (65), wherein one of the stator (32) and the frame (12) comprises a stopping portion (32a) allowing the hook portion (65) to be coupled thereto.
10. The compressor according to claim 9, wherein the

at least one extension comprises a first extension (62) extending upward from the coupling portion (61), a second extension (63) extending from the first extension (62) in a radial direction, and a third extension (64) extending upward from the second extension (63).

11. The compressor according to claim 1, wherein the raising member is a spiral member (80) coupled to an inner circumferential surface of the rotating shaft (70) to rotate together with the rotating shaft (70) to raise the oil retained in the hermetic case (10) in cooperation with the inner circumferential surface of the rotating shaft (70).
12. The compressor according to claim 11, further comprising a cap member (100) coupled to an end of the rotating shaft (70) to support the spiral member (80).
13. The compressor according to claim 12, wherein the cap member (100) is provided with a support surface (103) to support the spiral member (80).
14. The compressor according to claim 11, further comprising a fixation shaft (90) inserted into the hollow portion (74) of the rotating shaft (70) to support the spiral member (80).
15. The compressor according to claim 14, further comprising a fixing member (60) to fix the fixation shaft (90) to one of the stator (32) and the frame (12).

Patentansprüche

1. Kompressor (1), der umfasst:

ein hermetisches Gehäuse (10), das Öl in seinem unteren Abschnitt speichert;
 einen Rahmen (12), der in dem hermetischen Gehäuse (10) aufgenommen ist;
 einen Kompressions-Mechanismus (20), der mit einem an dem Rahmen (12) befestigten Zylinder (21) sowie einem Kolben (22) versehen ist, der sich hin- und herbewegt, um ein Kältemittel in dem Zylinder (21) zu komprimieren;
 einen Kraftübertragungs-Mechanismus (30), der mit einem an dem Rahmen (12) befestigten Stator (32) und einem Rotor (31) versehen ist, der so eingerichtet ist, dass er sich im Inneren des Stators (32) dreht; sowie
 eine rotierende Welle (40, 70), die mit einem hohlen Abschnitt (44, 74), in dem ein Förder-Element zum Fördern des in dem hermetischen Gehäuse (10) gespeicherten Öls angeordnet ist, und einer Spiralnut (46, 76) versehen ist, die mit dem hohlen Abschnitt (44, 74) in Verbindung steht und an einer Außenumfangsfläche der ro-

- tierenden Welle (40, 70) ausgebildet ist, wobei das in dem hermetischen Gehäuse (10) gespeicherte Öl über eine Innenumfangsfläche der rotierenden Welle (40, 70) gefördert wird und das geförderte Öl die rotierende Welle (40, 70) schmiert, während es über die Spiralnut (46, 76) nach unten fließt, der hohle Abschnitt (44, 74) eine Länge hat, die sich im Wesentlichen über die gesamte Länge der rotierenden Welle (40, 70) erstreckt, und sich das Förder-Element im Wesentlichen über die gesamte Länge des hohlen Abschnitts (44, 74) erstreckt.
2. Kompressor nach Anspruch 1, wobei das Förder-Element eine Befestigungswelle (50) ist, die an dem Stator (32) oder dem Rahmen (12) befestigt ist und mit einem Spiralfügel (51) an ihrer Außenumfangsfläche versehen ist, mit dem das in dem hermetischen Gehäuse (10) gespeicherte Öl im Zusammenwirken mit einer Innenumfangsfläche der rotierenden Welle (40) gefördert wird, wenn sich die rotierende Welle (40) dreht.
 3. Kompressor nach Anspruch 1, wobei die rotierende Welle (40, 70) mit einem Leitkanal (45, 75) versehen ist, der Öl in dem hohlen Abschnitt (44, 74) der rotierenden Welle (40, 70) zu der Spiralnut (46, 76) der rotierenden Welle (40, 70) leitet.
 4. Kompressor nach Anspruch 2, wobei die Spiralnut (46) der rotierenden Welle (40) und der Spiralfügel (51) der Befestigungswelle (50) in entgegengesetzten Richtungen ausgebildet sind.
 5. Kompressor nach Anspruch 2, wobei die rotierende Welle (40) aus einem Metallmaterial besteht und die Befestigungswelle (50) aus einem Kunststoffmaterial besteht.
 6. Kompressor nach Anspruch 2, der des Weiteren ein Fixier-Element (60) zum Fixieren der Befestigungswelle (50) an dem Stator (32) oder dem Rahmen (12) umfasst.
 7. Kompressor nach Anspruch 6, wobei das Fixier-Element (60) ein Draht ist, der die Befestigungswelle (50) durchdringt und so mit der Befestigungswelle (50) gekoppelt ist.
 8. Kompressor nach Anspruch 7, wobei die Befestigungswelle (50) einen Vorsprung (52) aufweist, der nach unten vorsteht und mit dem Fixier-Element (60) gekoppelt wird, wenn er in den hohlen Abschnitt (44) der rotierenden Welle (40) eingeführt wird, und der Vorsprung (52) der Befestigungswelle (50) mit einem Durchgangsloch (53) versehen ist, das das Fixier-Element (60) durchdringt.
 9. Kompressor nach Anspruch 7, wobei das Fixier-Element (60) einen mit der rotierenden Welle (40) gekoppelten Kopplungsabschnitt (61), einen mit dem Stator (32) oder dem Rahmen (12) gekoppelten Hakenabschnitt (65) sowie wenigstens eine Verlängerung zum Verbinden des Kopplungsabschnitts (61) mit dem Hakenabschnitt (65) umfasst, wobei der Stator (32) oder der Rahmen (12) einen Halteabschnitt (32a) umfasst, der Koppeln des Hakenabschnitts (65) damit ermöglicht.
 10. Kompressor nach Anspruch 9, wobei die wenigstens eine Verlängerung eine erste Verlängerung (62), die sich von dem Kopplungsabschnitt (61) nach oben erstreckt, eine zweite Verlängerung (63), die sich von der ersten Verlängerung (62) in einer radialen Richtung erstreckt, sowie eine dritte Verlängerung (64) umfasst, die sich von der zweiten Verlängerung (63) nach oben erstreckt.
 11. Kompressor nach Anspruch 1, wobei das Förder-Element ein spiralförmiges Element (80) ist, das mit einer Innenumfangsfläche der rotierenden Welle (70) gekoppelt ist und sich zusammen mit der rotierenden Welle (70) dreht, um das in dem hermetischen Gehäuse (10) gespeicherte Öl im Zusammenwirken mit der Innenumfangsfläche der rotierenden Welle (70) zu fördern.
 12. Kompressor nach Anspruch 11, der des Weiteren ein Kappen-Element (100) umfasst, das mit einem Ende der rotierenden Welle (70) gekoppelt ist, um das spiralförmige Element (80) zu tragen.
 13. Kompressor nach Anspruch 12, wobei das Kappen-Element (100) mit einer Tragefläche (103) zum Tragen des spiralförmigen Elementes (80) versehen ist.
 14. Kompressor nach Anspruch 11, der des Weiteren eine Befestigungswelle (90) umfasst, die in den hohlen Abschnitt (74) der rotierenden Welle (70) eingeführt ist, um das spiralförmige Element (80) zu tragen.
 15. Kompressor nach Anspruch 14, der des Weiteren ein Fixier-Element (60) zum Fixieren der Befestigungswelle (90) an dem Stator (32) oder dem Rahmen (12) umfasst.
- ## Revendications
1. Compresseur (1) comprenant :
 - un carter hermétique (10) pour retenir l'huile dans une partie inférieure de celui-ci ;
 - un châssis (12) logé dans le carter hermétique (10) ;

- un mécanisme de compression (20) muni d'un cylindre (21) fixé au cadre (12), et d'un piston (22) pour aller et venir afin de comprimer un réfrigérant dans le cylindre (21) ;
 un mécanisme de transmission de puissance (30) muni d'un stator (32) fixé au châssis (12) et d'un rotor (31) adapté pour tourner à l'intérieur du stator (32) ; et
 un arbre rotatif (40, 70) muni d'une partie creuse (44, 74) ayant un élément de soulèvement pour soulever l'huile retenue dans le carter hermétique (10) disposé dans celui-ci, et une rainure en spirale (46, 76) communiquant avec la partie creuse (44, 74) et formée sur une surface circonférentielle extérieure de l'arbre rotatif (40, 70),
 dans lequel l'huile retenue dans le carter hermétique (10) est soulevée par l'intermédiaire d'une surface circonférentielle intérieure de l'arbre rotatif (40, 70), et l'huile soulevée lubrifie l'arbre rotatif (40, 70) tout en descendant à travers la rainure en spirale (46, 76),
 dans lequel la partie creuse (44, 74) a une longueur qui s'étend sensiblement sur toute la longueur de l'arbre rotatif (40, 70), et l'élément de soulèvement s'étend sensiblement sur toute la longueur de la partie creuse (44, 74).
2. Compresseur selon la revendication 1, dans lequel l'élément de soulèvement est un arbre de fixation (50) fixé à l'un parmi le stator (32) et le châssis (12), et muni d'une ailette en spirale (51) sur une surface circonférentielle extérieure de celui-ci pour soulever l'huile retenue dans le carter hermétique (10) en coopération avec une surface circonférentielle intérieure de l'arbre rotatif (40) lorsque l'arbre rotatif (40) tourne.
 3. Compresseur selon la revendication 1, dans lequel l'arbre rotatif (40, 70) est muni d'un passage de guidage (45, 75) pour guider de l'huile dans la partie creuse (44, 74) de l'arbre rotatif (40, 70) vers la rainure en spirale (46, 76) de l'arbre rotatif (40, 70).
 4. Compresseur selon la revendication 2, dans lequel la rainure en spirale (46) de l'arbre rotatif (40) et l'ailette en spirale (51) de l'arbre de fixation (50) sont formées dans des directions opposées.
 5. Compresseur selon la revendication 2, dans lequel l'arbre rotatif (40) est formé d'un matériau métallique, et l'arbre de fixation (50) est formé d'un matériau en résine synthétique.
 6. Compresseur selon la revendication 2, comprenant en outre un élément de fixation (60) pour fixer l'arbre de fixation (50) à l'un parmi le stator (32) et le châssis (12).
 7. Compresseur selon la revendication 6, dans lequel l'élément de fixation (60) est un fil couplé à l'arbre de fixation (50) en pénétrant dans l'arbre de fixation (50).
 8. Compresseur selon la revendication 7, dans lequel l'arbre de fixation (50) comprend une saillie (52) faisant saillie vers le bas pour être couplée à l'élément de fixation (60) lorsqu'elle est insérée dans la partie creuse (44) de l'arbre rotatif (40), dans lequel la saillie (52) de la tige de fixation (50) est munie d'un trou traversant (53) pénétré par l'élément de fixation (60).
 9. Compresseur selon la revendication 7, dans lequel l'élément de fixation (60) comprend une partie de couplage (61) couplée à l'arbre rotatif (40), une partie de crochet (65) couplée à l'un parmi le stator (32) et le châssis (12), et au moins une extension pour connecter la partie de couplage (61) à la partie de crochet (65),
 dans lequel l'un parmi le stator (32) et le châssis (12) comprend une partie d'arrêt (32a) permettant à la partie de crochet (65) d'être couplée à celle-ci.
 10. Compresseur selon la revendication 9, dans lequel la au moins une extension comprend une première extension (62) s'étendant vers le haut à partir de la partie de couplage (61), une deuxième extension (63) s'étendant à partir de la première extension (62) dans une direction radiale, et une troisième extension (64) s'étendant vers le haut à partir de la deuxième extension (63).
 11. Compresseur selon la revendication 1, dans lequel l'élément de soulèvement est un élément en spirale (80) couplé à une surface circonférentielle intérieure de l'arbre rotatif (70) pour tourner conjointement avec l'arbre rotatif (70) afin de soulever l'huile retenue dans le carter hermétique (10) en coopération avec la surface circonférentielle intérieure de l'arbre rotatif (70).
 12. Compresseur selon la revendication 11, comprenant en outre un élément de capot (100) couplé à une extrémité de l'arbre rotatif (70) pour supporter l'élément en spirale (80).
 13. Compresseur selon la revendication 12, dans lequel l'élément de capot (100) est muni d'une surface de support (103) pour supporter l'élément en spirale (80).
 14. Compresseur selon la revendication 11, comprenant en outre un arbre de fixation (90) inséré dans la partie creuse (74) de l'arbre rotatif (70) pour supporter l'élément en spirale (80).

15. Compresseur selon la revendication 14, comprenant en outre un élément de fixation (60) pour fixer l'arbre de fixation (90) à l'un parmi le stator (32) et le châssis (12).

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FIG. 1

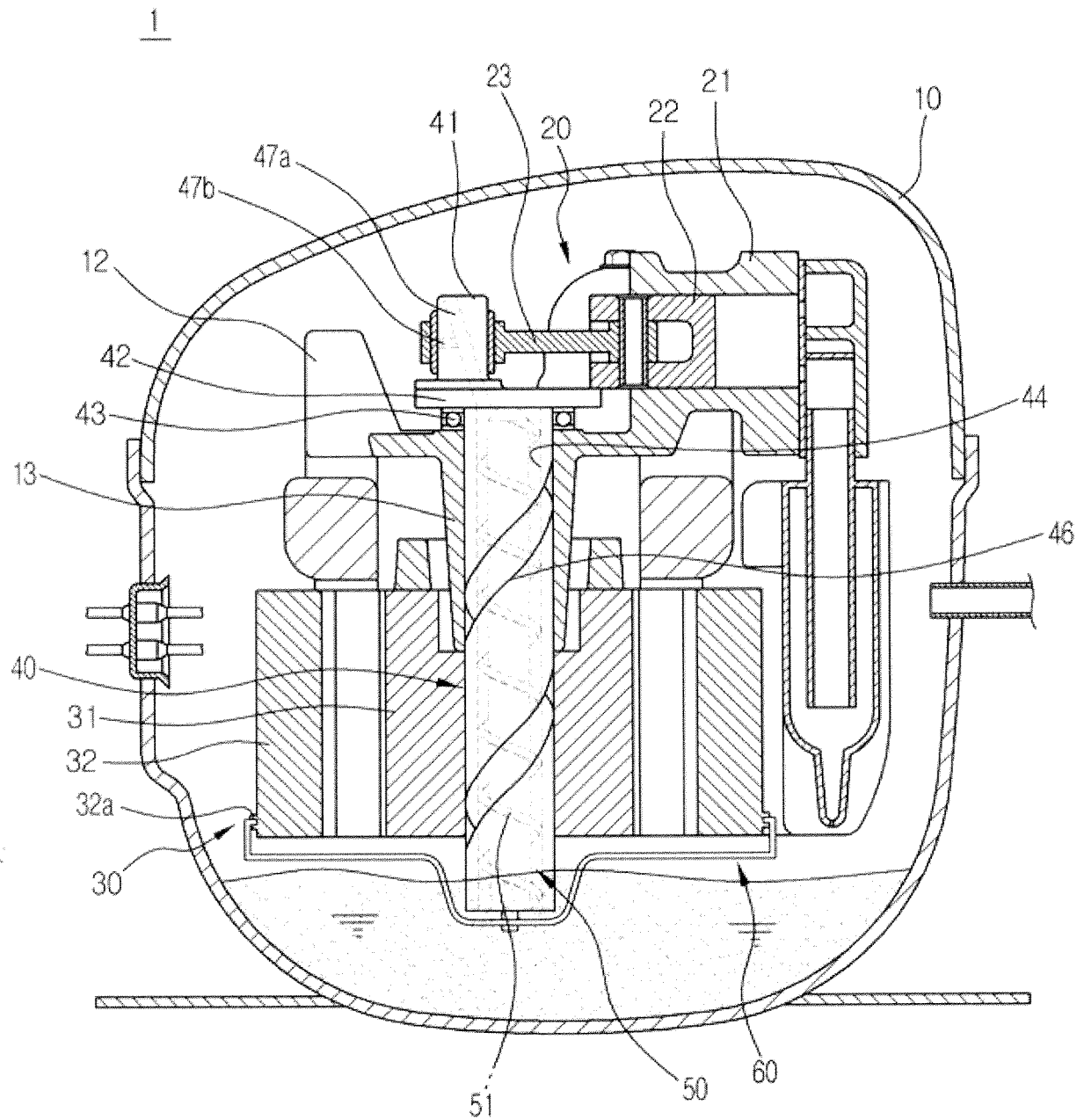


FIG.2

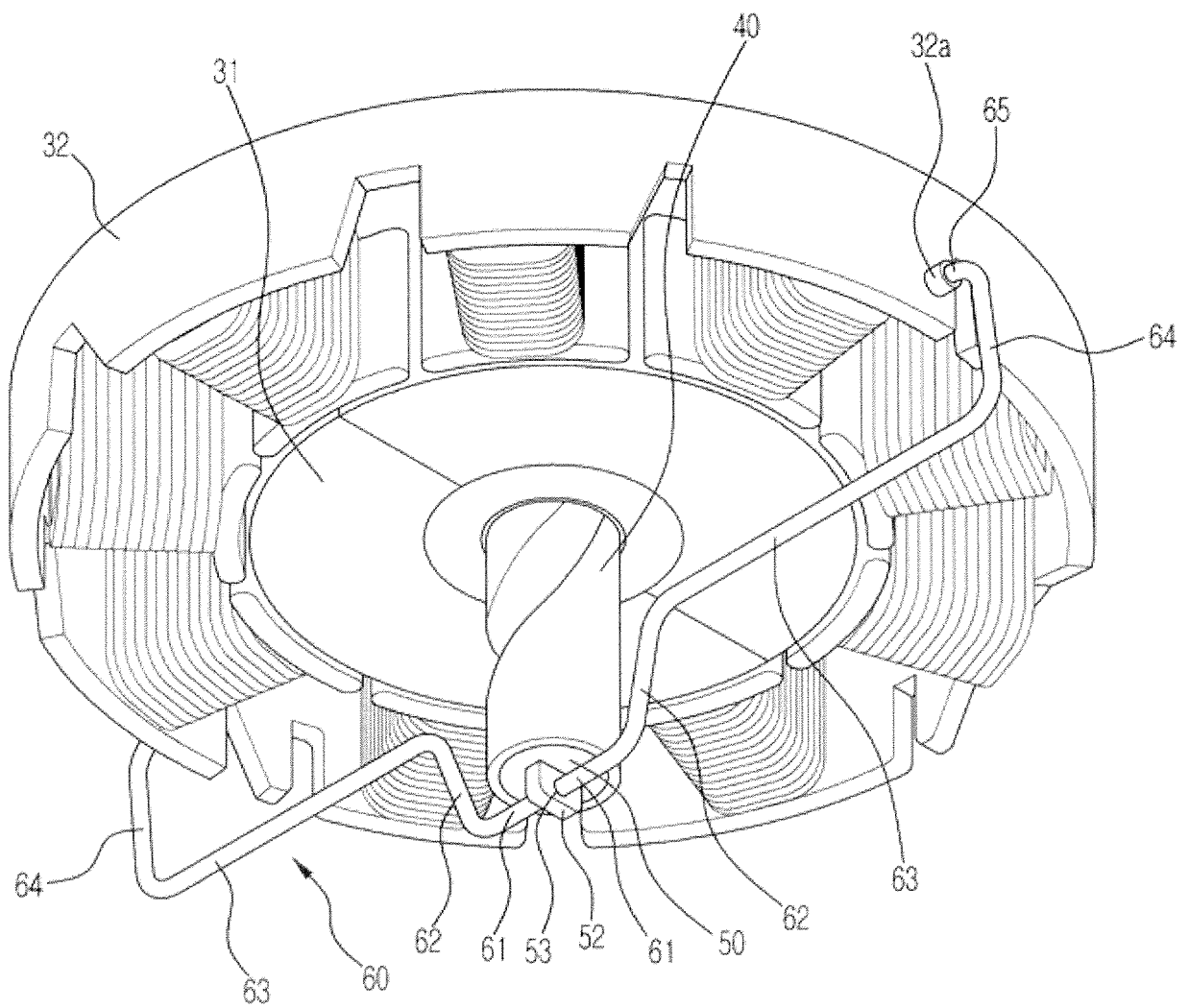


FIG.3

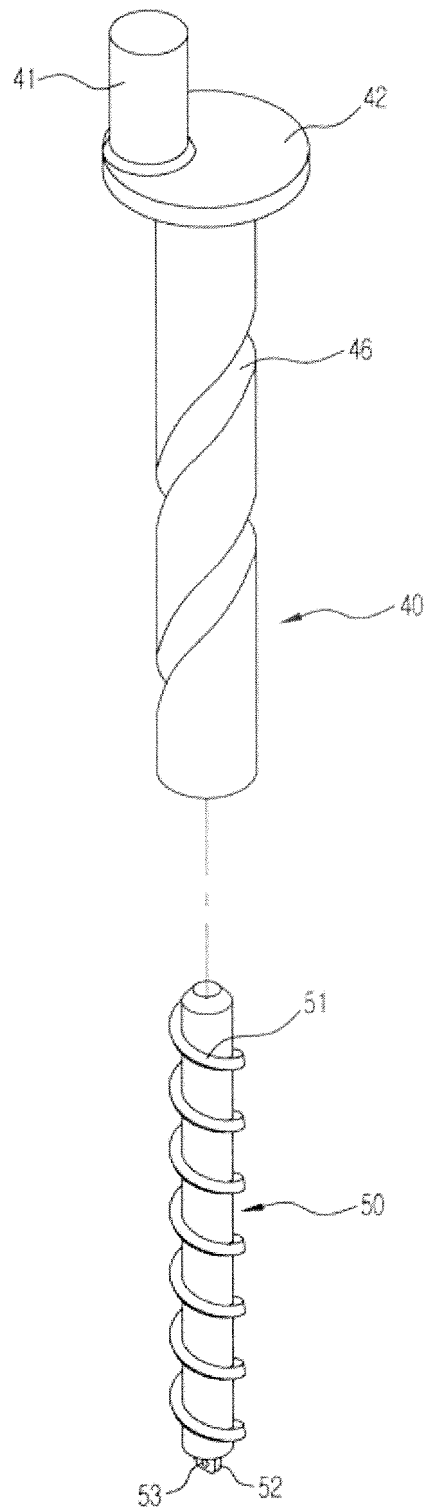


FIG.4

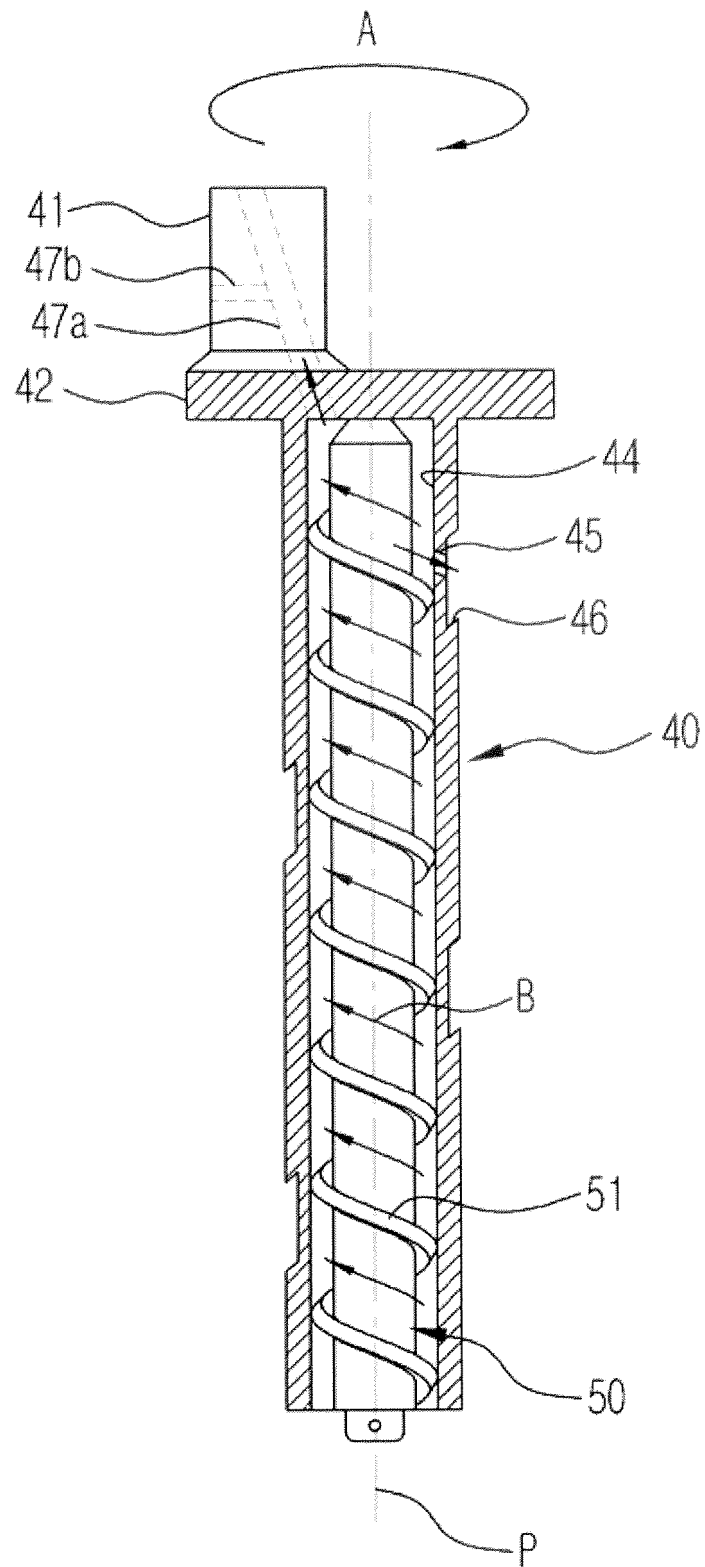


FIG.5

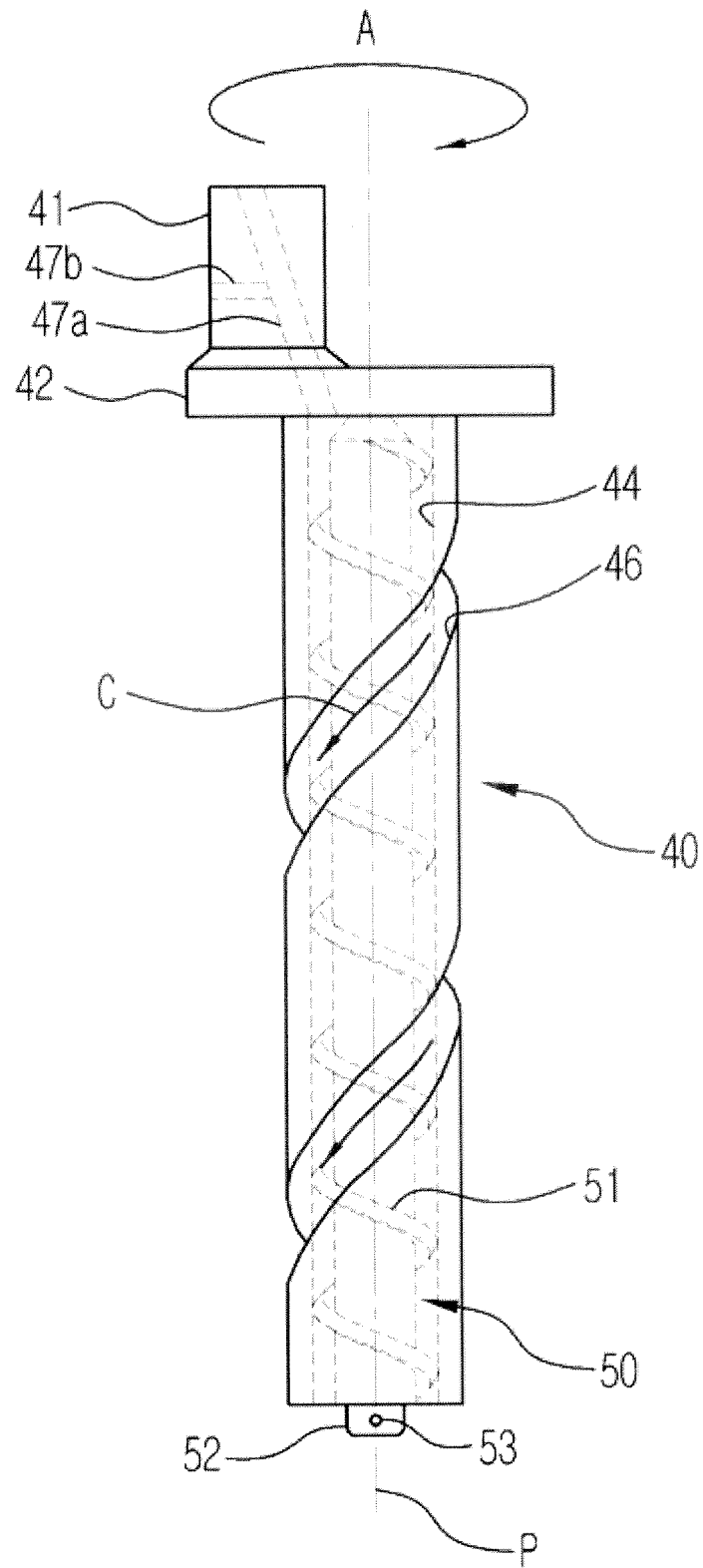


FIG.6

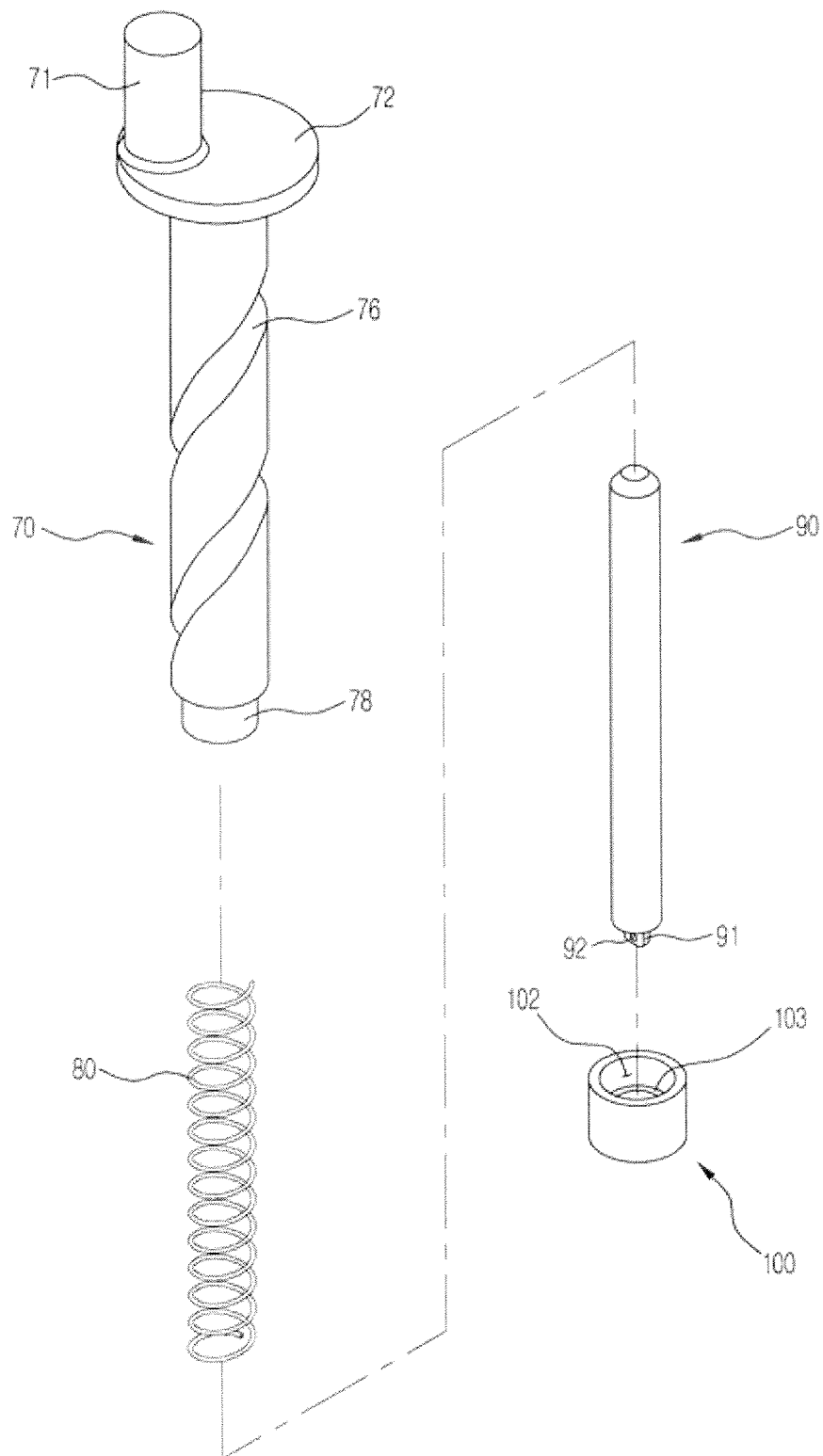


FIG. 7

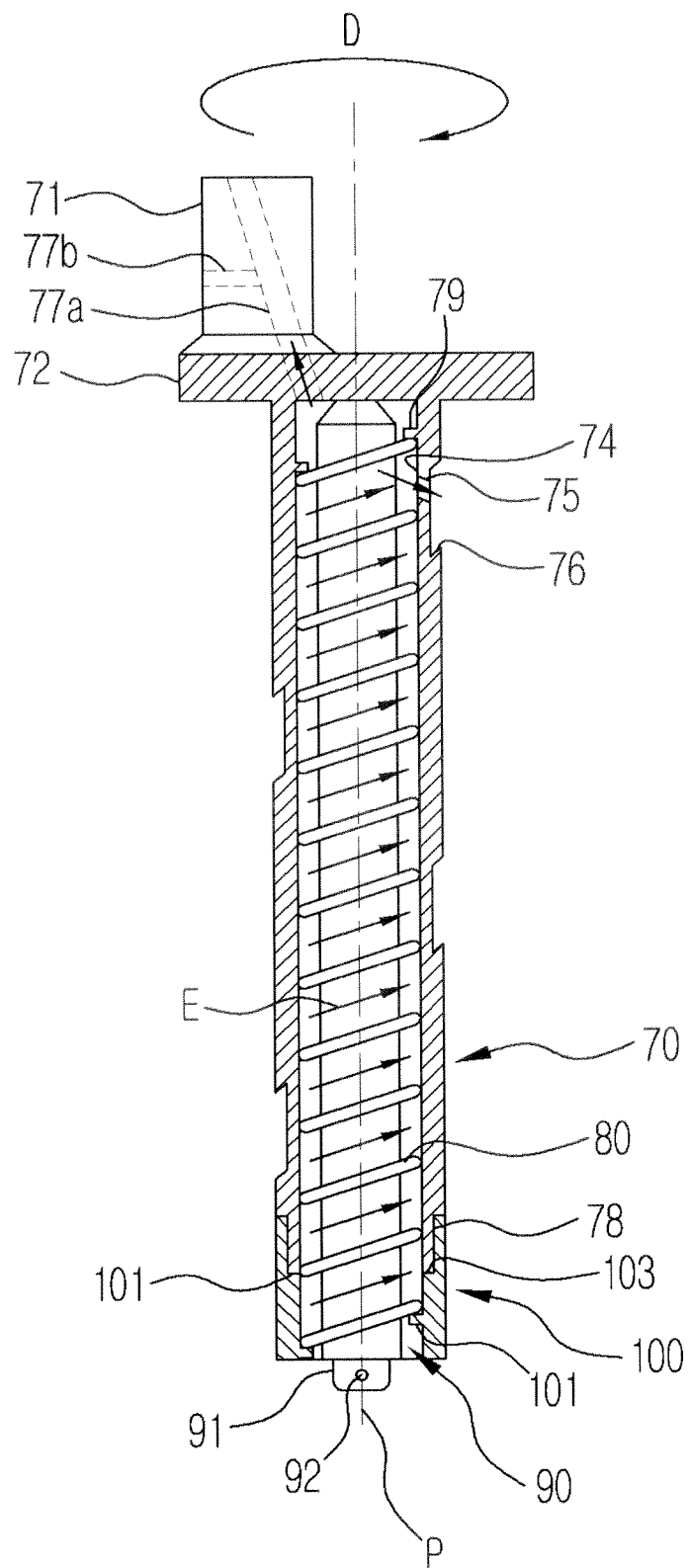
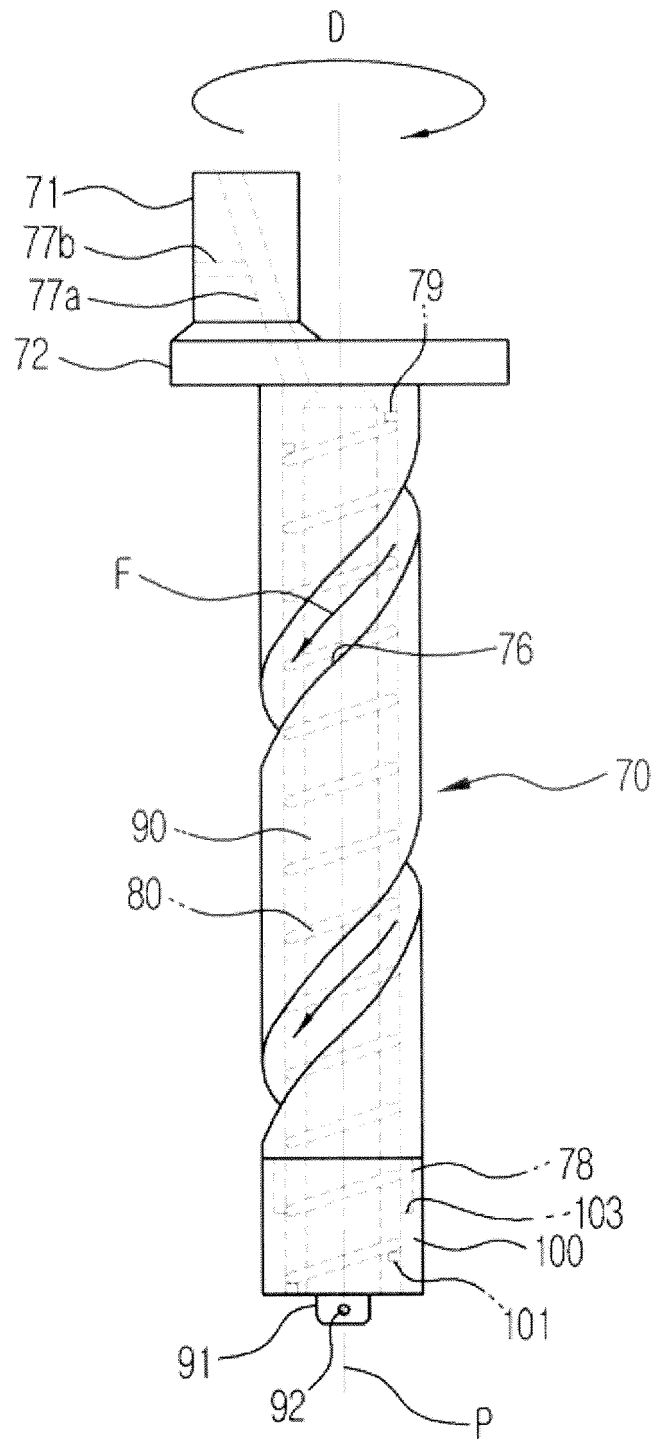


FIG.8



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 20050052011 A [0004]
- US 20070020126 A1 [0005]